Water Availability Modeling Neches and Sabine River Basins

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Topics

- Water Availability Models (WAM)
  - General Information
  - How WAMs work
- Sabine and Neches WAMs – Specifics
- Water Availability
- WAMs & Instream Flow Requirements
- WAM Outputs
- WAM on the Web

Water Availability Models

- **Before 1970s**
  - **Various methods**
  - **Early rights (granted before the 1950s) did not consider the Drought of Record**
- **During Adjudication**
  - **Determinations based on historical use**
- **Post 1970**
  - **Legacy Models**
    - **Return flows included in some basins**
    - **Not completed for all basins**

Senate Bill 1

- In response to drought conditions in the 1990s, the Texas Legislature implemented Regional Water Planning in 1997

- This legislation also included funding for the creation of new Water Availability Models for 22 of the 23 river basins in the state. (Funding for the additional basin, the Rio Grande, was authorized in 2001)

So, what is a WAM?

A **Water Availability Model** is a computer simulation used to predict the amount of water that would be available in a river or stream under a specified set of conditions.

What can a WAM do?

- It is based on historic hydrology and allocates water in accordance with the prior appropriation doctrine
- It is not a picture of what happened in 1945, or 1972
- It does not differentiate water quality
- It may not model all components of a water right (some special conditions)

Modeling Process

Naturalized Streamflow

- **The amount of water in the stream that would be there if not for the influence of man's activities**
- **Naturalized streamflow cannot be directly measured, yet it is the baseline condition for water availability accounting.**
- **For most Texas river systems, the naturalized flows encompass at least a fifty-year period of record that includes the drought of the 1950s.**
- **The period of record also includes major floods and less severe droughts, thereby representing an approximation of historic hydrologic variability.**

Full Authorization Simulation

- Used to evaluate applications for perpetual water rights and some amendments
- As-built area-capacity information for reservoirs
- No return flows
- All water rights utilize their maximum authorized amounts

Current Conditions Simulation

- Used to evaluate applications for term water rights and some amendments
- Uses self-reported water use data for diversion amounts, uses the maximum reported value for the ten year period preceding the model construction
- Year 2000 area-capacity information for reservoirs (to account for sedimentation)
- Includes return flows

Water Availability Modeling in the Neches River Basin

- Sam Rayburn and Steinhagen Reservoirs are operated as a system
- Special conditions of water rights are included
- This model is run as a Dual Simulation. This means that the model executes twice.

Water Availability Modeling in the Sabine River Basin

- Sabine River Compact adds complexity
  - Provisions for 36 cfs at the Stateline
  - Toledo Bend Reservoir
    - Subordination of Toledo Bend to the upper basin
    - 50/50 split
  - Compact requirements in the lower basin
  - This model is run as a Dual Simulation

Water Availability in General

- WAMs include water rights management strategies, environmental flow requirements and interstate compact requirements.
- The WAM uses prior appropriation accounting to determine how much water a water right can impound or divert. Water availability is calculated by taking the amount of flow in the stream and subtracting the amount of flow appropriated to other water rights.
- The amount of water available for appropriation is limited by the amount of the instream flow requirement.

Water Availability Determinations

- For new permits, the amount of flow appropriated to others is the full amount of the paper water right. Any remaining water may be available for appropriation. Term permits are based on appropriated but unused water

- Reuse Permits
  - Surface Water
  - Groundwater

- Other Types of Permits
  - Conjunctive use of surface water and groundwater
  - Overdrafting

Water Availability Maps

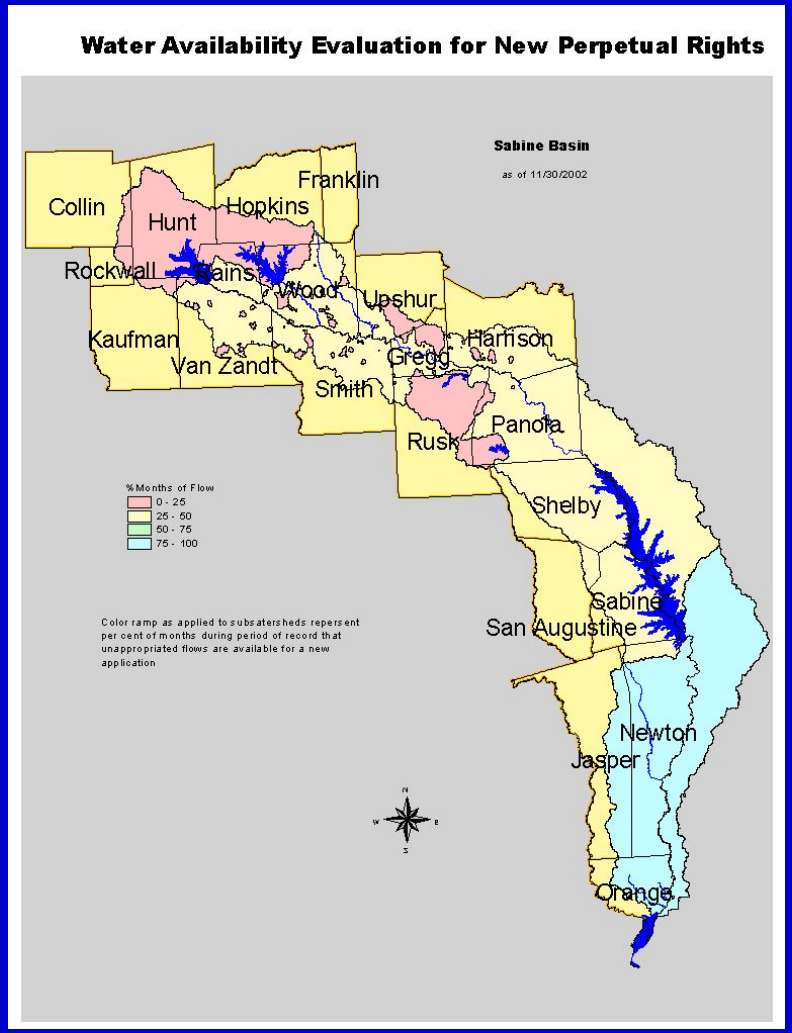
The maps do not show:

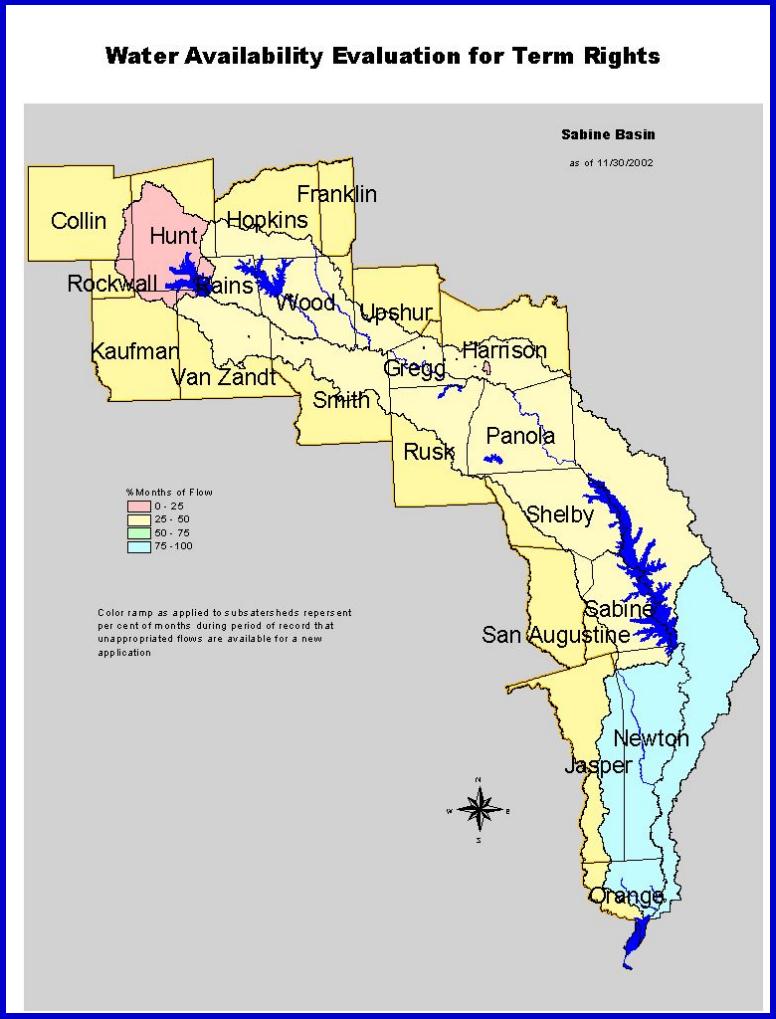
- The quantity of streamflow present at any given location (i.e. gageflow)
- The quantity of water available for appropriation at any give location

The maps do show:

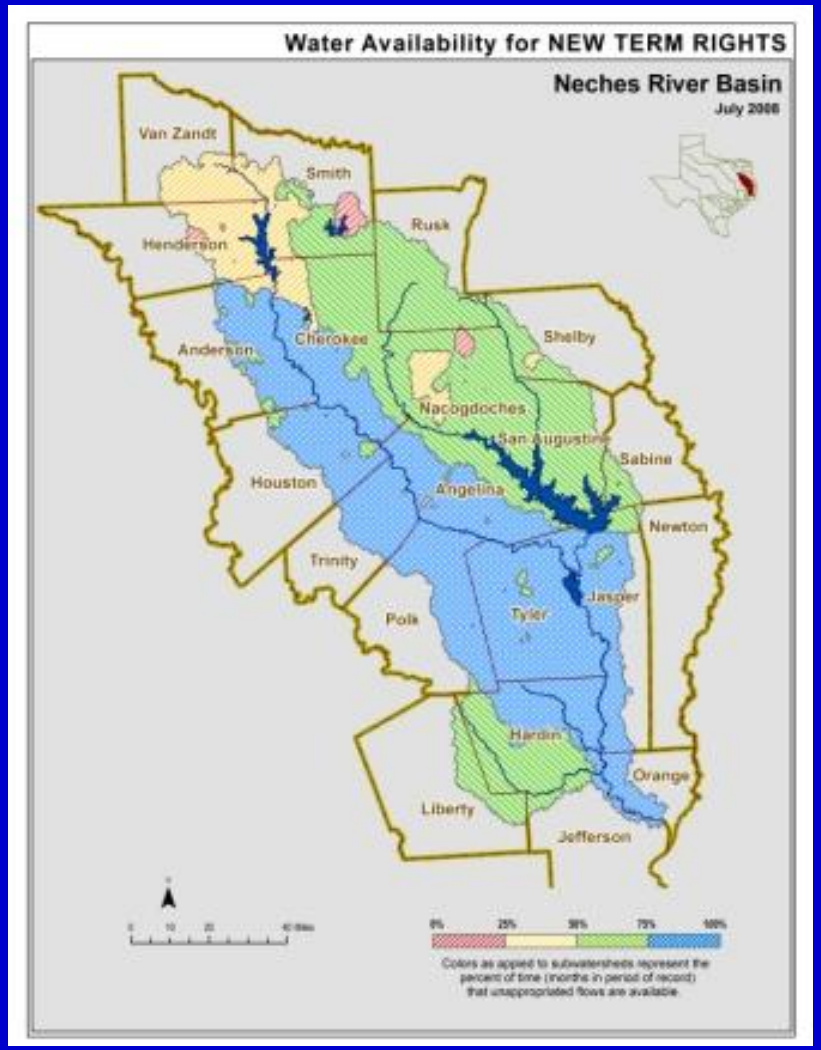
- Where no water is available for appropriation
- How often *some* water is available for appropriation

General Water Availability Maps for the Sabine River Basin





General Water Availability Maps for the Neches River Basin



WAM & Instream Flow Requirements

- Lyons Method requirements or other similar type recommendations are incorporated into the WAMs by converting the monthly requirement in cfs to acre-feet
- New capabilities required for Texas Water Availability Models: Project completed May 2007
- Variable instream flow requirements and the WAM
  - Pulse flows may be computed outside the WAM and a conservative approximation included
  - A streamflow requirement that depends on whether a season is classified as wet, average, or dry can be modeled based on the applicable triggers using WAM functions such as DI or FS records

Water Availability Model Output

- Unappropriated flows
- Reliability of water rights
- Reservoir/system operations – end of month storage
- Naturalized & Regulated flows
- Instream flow frequency

Water Availability Model Output Formats

Text file for use with the Tables post-processing software

MONTHLY SUMMARY TABLE FOR RESERVOIR RAYBRN

YEAR	MONTH	EOP STORAGE (AC-FT)	STORAGE CHANGE (AC-FT)	EVAPORATION (AC-FT)	RELS + DEPLS INTO (AC-FT)	RELS FROM (AC-FT)	POWER PRODUCED (MW-HR)	POWER SHT(+)/2nd(-) (MW-HR)
1940	1	2898200.0	0.0	3435.0	5255.0	1820.0	0.0	0.0
1940	2	2898200.0	0.0	-2290.0	-638.0	1652.0	0.0	0.0
1940	3	2898200.0	0.0	19465.0	21369.0	1904.0	0.0	0.0
1940	4	2898200.0	0.0	-18320.0	-16360.0	1960.0	0.0	0.0
1940	5	2898200.0	0.0	16030.0	18270.0	2240.0	0.0	0.0
1940	6	2898200.0	0.0	2290.0	4950.0	2660.0	0.0	0.0
1940	7	2898200.0	0.0	17175.0	20591.0	3416.0	0.0	0.0
1940	8	2898200.0	0.0	-14885.0	-11497.0	3388.0	0.0	0.0
1940	9	2838747.5	-59452.6	39816.0	35439.5	55076.1	0.0	0.0
1940	10	2750215.0	-88532.5	26860.4	0.0	61672.2	0.0	0.0
1940	11	2898200.0	147985.0	-64215.1	85701.9	1932.0	0.0	0.0
1940	12	2898200.0	0.0	-12595.0	-10775.0	1820.0	0.0	0.0
1941	1	2898200.0	0.0	17175.0	18995.0	1820.0	0.0	0.0
1941	2	2898200.0	0.0	-9160.0	-7508.0	1652.0	0.0	0.0
1941	3	2898200.0	0.0	13740.0	15644.0	1904.0	0.0	0.0
1941	4	2898200.0	0.0	5725.0	7685.0	1960.0	0.0	0.0
1941	5	2898200.0	0.0	-16030.0	-13790.0	2240.0	0.0	0.0
1941	6	2898200.0	0.0	-9160.0	-6500.0	2660.0	0.0	0.0
1941	7	2898200.0	0.0	-16030.0	-12614.0	3416.0	0.0	0.0
1941	8	2855829.2	-42370.8	35331.5	35291.9	42331.1	0.0	0.0
1941	9	2898200.0	42370.8	-28493.2	16677.6	2800.0	0.0	0.0
1941	10	2898200.0	0.0	-74425.0	-72017.0	2408.0	0.0	0.0
1941	11	2898200.0	0.0	51525.0	53457.0	1932.0	0.0	0.0
1941	12	2898200.0	0.0	8015.0	9835.0	1820.0	0.0	0.0
1942	1	2898200.0	0.0	11450.0	13270.0	1820.0	0.0	0.0
1942	2	2898200.0	0.0	2290.0	3942.0	1652.0	0.0	0.0

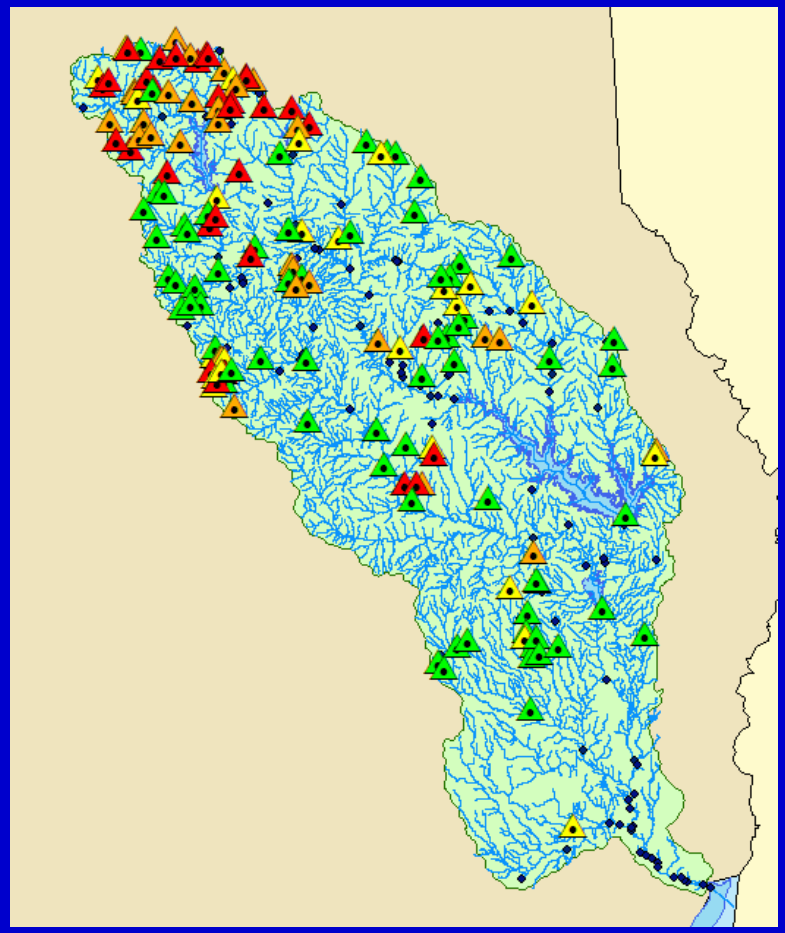
Water Availability Model Output Formats

WRAP GUI converts the text file to a geodatabase for use in GIS applications

Attributes of ReservoirTS

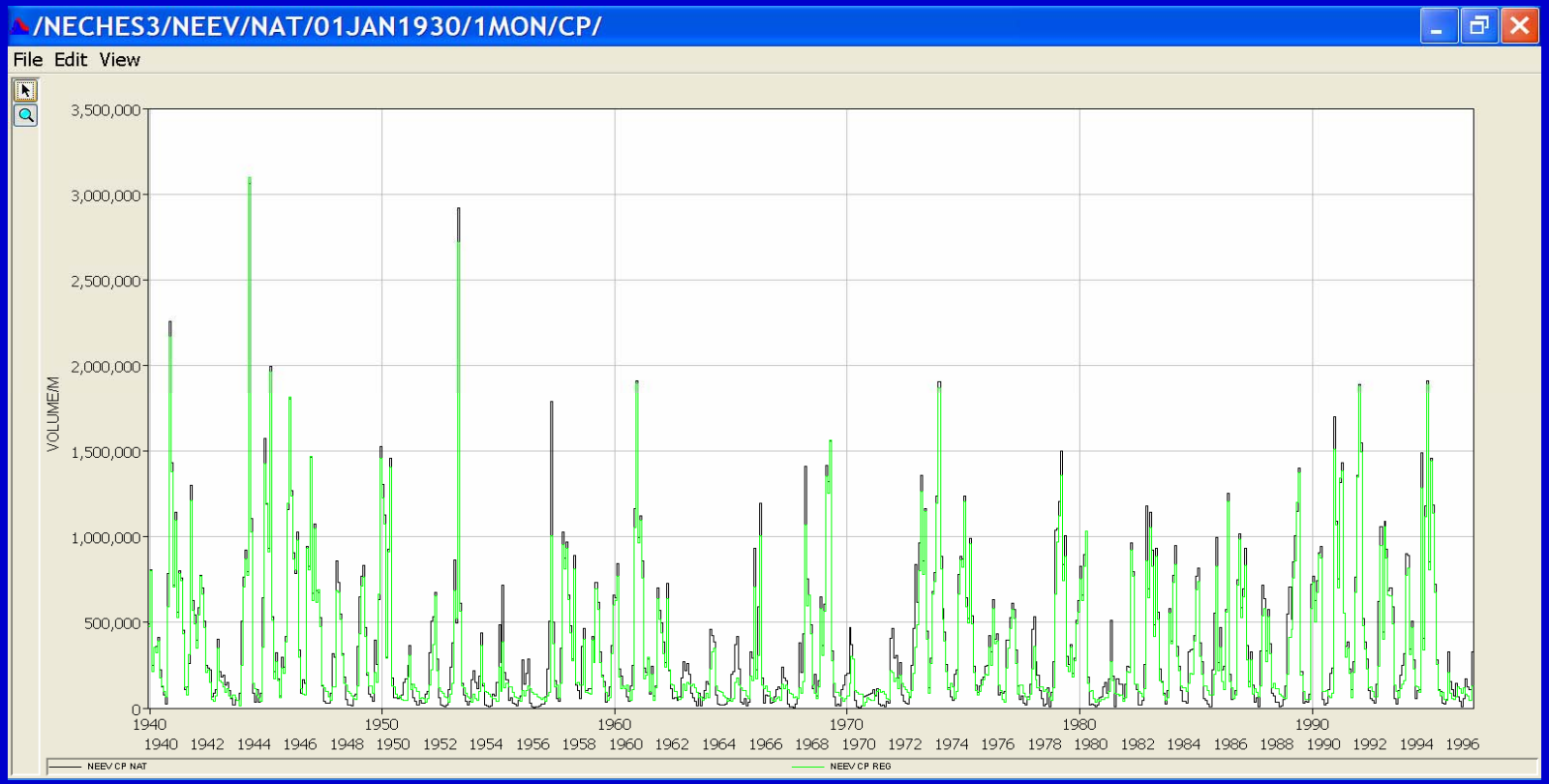
ObjectID *	HydroCode *	TSDateTime	HydShort	Energy	Evap	EopSto
1	472436	1/1/1940	0	0	0.06	1.94
2	472435	1/1/1940	0	0	0.09	3.61
3	FLOR	1/1/1940	0	0	1.55	365.45
4	UMPRY	1/1/1940	0	0	0	482
5	WALLAC	1/1/1940	0	0	0.58	47
6	BEASLY	1/1/1940	0	0	0.74	69.16
7	MEWBRN	1/1/1940	0	0	0.6	49.38
8	COX1	1/1/1940	0	0	2.79	596.81
9	WISE	1/1/1940	0	0	1.14	222.86
10	PROJAM	1/1/1940	0	0	0.99	111.01
11	CALEND	1/1/1940	0	0	10.65	3403.35
12	ROBERT	1/1/1940	0	0	4.58	1337.42
13	DUNCAN	1/1/1940	0	0	0.33	29.37
14	COLINS	1/1/1940	0	0	0.57	70.93
15	HAND	1/1/1940	0	0	0.8	126.5

Record: 1 Show: All Selected Records (0 out of 121068 Se



Water Availability Model Output Formats

DSS format for use in HEC applications such as HEC-RPT or other modeling software



Water Availability Modeling on the Web

- Available at http://www.tceq.state.tx.us/permitting/water_supply/water_rights/wam.html
- Water Availability Maps by River Basin
- Link to WRAP Programs and Manuals
- GIS Data available
- Input Files by River Basin

Questions?

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